

on the slit of the ordinary spectroscope the coloured image produced at the focus of the telescope. 2°, the other less costly means consists in placing a direct-vision prism of great dispersive power in the course of the luminous rays before they arrive at the focus, and on the slit of the ordinary spectroscope.

By these two means we obtain in the field of the spectroscope the solar image formed of different coloured hues, with their spectral rays, but very precise and detailed, with the spots and edges very precise, so that it is possible to make out the details of the spots, as one would do with a coloured glass. If the solar edge falls near the ray C, which (as I have said) one sees at the same time with the image of the spots, one sees the chromosphere and protuberances mark themselves out like brilliant lines, more or less distant from the edge according to the height of the protuberances. The image of the spots is sharper as the slit is narrower. Thus one sees the protuberances as brilliant lines, but one only recognises their form by linear sections, as in Janssen's old method. It is, nevertheless, possible perfectly to make out and measure their height by measuring the distance of the (now brilliant) line C from the point of the solar boundary which is on the same normal therewith. One can also, by broadening the slit, make out the form of the protuberance, but there is then a loss of precision in the image. But keeping the slit narrow, one can make out with the greatest precision the height and place of the protuberances, and fix their position in respect to the spots and faculæ, in a much more simple and surer manner than with the ordinary spectroscope.

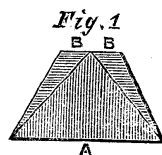
If in a spot there is a jet of hydrogen, one sees there the line C become brilliant, or at least diminish in blackness, and the calcium and iron lines grow broader, &c., as in the ordinary observations, but with greater satisfaction and accuracy of position.

Note on the use of Compound Prisms. By John Browning, Esq.

As some attention is being directed to the use of compound prisms, I think it desirable to place on record in the *Monthly Notices* the steps I have taken towards their introduction.

In 1864 Mr. Gassiot asked me to make for him a very powerful battery of bisulphide of carbon prisms.

Instead of making the sides of these prisms of plane and parallel glass, I cemented crown-glass prisms on to them in the manner shown in the diagram (fig. 1), where A represents the fluid prism, and B B the crown-glass prisms added on either side.



This battery of prisms was described in the *Proceedings of*

the *Royal Society*, vol. xiii. p. 185, in a paper read by Mr. Gassiot, April 7th, 1864. From this paper I take the following extract:—

“In place of giving to the fluid prisms two pairs of parallel sides, advantage has been taken by Mr. Browning of the difference between the refractive and dispersive properties of crown glass and bisulphide of carbon; and prisms of crown glass, having a refracting angle of 6° , have been substituted for one of the outer plates of each prism, the bases of these crown-glass prisms being brought to correspond with the apex of the fluid prism.

“By this means the angle of minimum deviation of the prisms is so much altered that eleven prisms can be used instead of eight. An increase of dispersive power, due to refracting angles of 150° of the bisulphide of carbon, is thus gained, minus only the small amount of dispersion counteracted by the dispersive power of the crown-glass prisms in the contrary direction.”

In July 1869, at the suggestion of Dr. Robinson, of Armagh, I made a large dense glass prism of 60° into a compound prism, the refracting angle of the dense prism being altered to 90° .

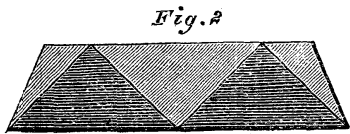
Since that time I have made several compound prisms of very dense flint glass and light crown glass, for the present Earl of Rosse.

The reason I have not used such compound prisms more generally is that such prisms are more expensive than ordinary prisms, even allowing for the extra dispersive power obtained, and that in consequence of the minimum angle of deviation of compound prisms being greater, and their length greater, the size of spectroscopes would require to be increased, and they would thus be rendered more cumbersome, as well as more expensive.

A smaller number of compound prisms will produce a given amount of dispersion; but the number of prisms to be made is, under the most favourable circumstances, three instead of two; and in the case of a circular battery the smaller number of prisms will occupy a larger circle. The number of plane faces is also greater for a given amount of dispersion, the practical difficulties in securing accuracy not being diminished by the fact that four faces out of the six in a compound prism are connected together.

On the score of saving light such prisms possess undoubtedly some advantage.

After writing the above, Mr. Lewis Rutherford, of New York, has requested me to make him a compound prism of glass on a plan which seems to possess some advantages over any hitherto used. The diagram (fig. 2) represents this prism.



In this diagram the two darkly shaded prisms are of dense flint of 90° , while the three other prisms are of crown. Such a prism is very nearly equal in dispersive power to three ordinary flint-glass prisms of 60° . There is no loss of light at the two intermediate surfaces, and it is much more compact.

I have found by experiment that the angles of the flint-glass prisms in this arrangement cannot with advantage be made more than 90° , nor the outside crown-glass prisms less than 30° .

A Contrivance for a double Automatic Spectroscope, with compound Prisms on Mr. Grubb's plan. By Richard A. Proctor, B.A., Cambridge.

Mr. Browning having succeeded in constructing a double-battery spectroscope on the plan I submitted to the Society last December—with, however, a slight modification in the contrivance for automatic adjustment—I am encouraged to believe that the plan I am now about to describe will be found feasible; though certainly the difficulties which the optician will have to surmount are by no means slight.

I propose the substitution of Mr. Grubb's compound prism for the single prisms in my double battery, the single intermediate prism being replaced by an intermediate compound prism, shaped as shown in the accompanying view (fig. 1) of the complete

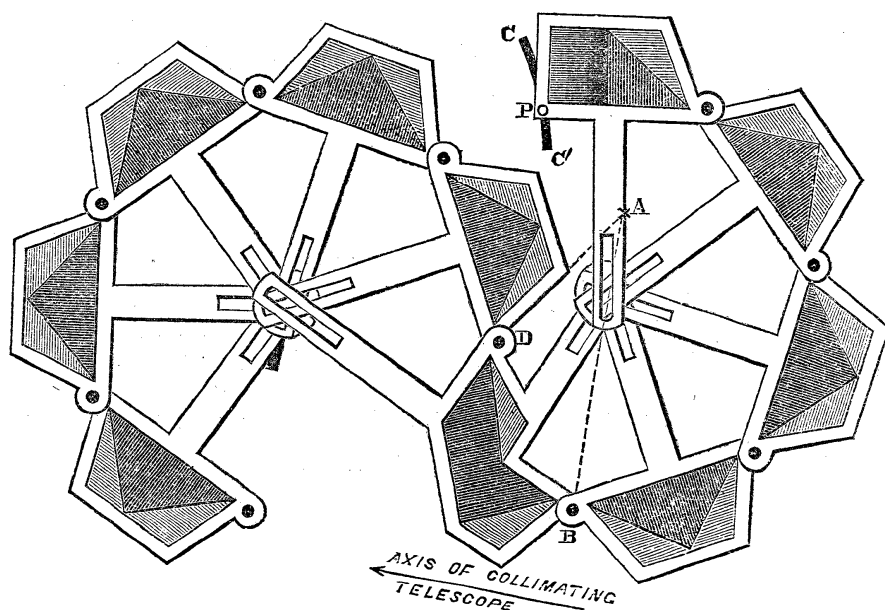


Fig. 1.

double battery. (The pivots on which the slots work have been omitted by the engraver.) This view, with the description given in my former paper serves to explain how the automatic adjustment is secured. But it will be noticed that the radial bar and the long slotted bar of the former description are removed. As I partly suspected when I suggested their use, they fail to communicate motion effectively to the second battery. The reason is easily seen: they work on that end of the second battery which